Proceedings of a Workshop on Arctic Marine Environmental Quality

Held: June 1-2, 1988
at Northern United Place,
Yellowknife, N.W.T.

Workshop sponsored by:

Environment Canada
Western and Northern Region

Department of Fisheries and Oceans
Pacific and Freshwater Fisheries

Indian and Northern Affairs Canada
Northwest Territories

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PROCEEDINGS OF A WORKSHOP ON ARCTIC MARINE ENVIRONMENTAL QUALITY

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ACKNOWLEDGEMENTS

Members of the Steering Committee would like to acknowledge and thank Russell Shearer for the remarkable job of pulling together the results of the workshop into a manageable first draft. These efforts made the job of the Steering Committee in finalizing the proceedings a much easier task.

EXECUTIVE SUMMARY

A two-day workshop sponsored by the Departments of Environment, Fisheries and Oceans and Indian and Northern Affairs was held to discuss issues related to Arctic marine environmental quality. This action followed two federal initiatives: introduction of an Arctic Marine Conservation Strategy by the Department of Fisheries and Oceans, and preparation of a Marine Environment Quality framework by Conservation and Protection, Environment Canada.

The workshop participants identified sixteen issues relating to marine environmental quality in Canada's northern waters. The participants also recommended that action be taken by federal departments in concert with industry and the Government of the Northwest Territories to resolve these issues.

Marine environmental quality issues differ according to the existing level of on-going activity, the ease of seeking solutions, the extent of control within Canada, and the level of resource commitments that will be required to implement various recommendations. In order to better reflect these differences, the issues, the recommendations forming the action plan were grouped into three categories.

SHORT-TERM ISSUES

3.1.1 Arctic Marine Environmental Quality Criteria and Standards

(i) A working group should be established to determine whether marine environmental criteria are required for the Arctic. If it is determined that criteria and standards are required then the working group:

(ii) Should identify parameters for which criteria or standards would be useful;

(iii) Should determine whether area-specifi criteria and standards are required (i.e., are different criteria and standards required for Lancaster Sound, the Beaufort Sea and Hudson Bay?); and

(iv) Should recommend on a process to begin development and implementing a complete set of criteria and standards within five years.

3.1.2 Reporting on the State of the Arctic Marine Environment

(i) Environment Canada should complete its draft report entitled "Present Status of Arctic Marine Environmental Quality" to reflect the issues discussed at this workshop.

(ii) The above draft report should be forwarded to agencies represented at the workshop for review prior to producing the final report for publication by March 31, 1989.

(iii) A state of the Arctic marine environment report should be produced every five years (i.e., next report should be produced in the fiscal year 1993/94).

3.1.3 Long-Term Environmental Monitoring Programmes

(i) Well designed, comprehensive, long-term monitoring programmes should be established to identify trends in Arctic marine environmental quality.

(ii) The monitoring programmes should be designed address long-range transport of cont. nants and local contamination issues.

(iii) Joint monitoring programmes between government departments and industry should be pursued.

(iv) Industry and government agencies should work together to seek resources for the monitoring programmes.

3.1.4 Marine Protected Areas

(i) The Department of Fisheries and Oceans, Canadian Wildlife Service and Canada Parks Service should continue their initiatives to establish a network of marine protected areas throughout the Arctic.

(ii) The selection of areas for protection should be based on appropriate biophysical and socio-economic information, and should reflect input from area residents, other government departments and industry.

3.1.5 Oil Spills

(i) Government and industry should work together to compile existing oceanographic and atmospheric data to support the refinement of oil spill trajectory models and identify information gaps which hinder such refinement.

(ii) An oil spill response atlas should be developed next for Lancaster Sound and then possibly for other Arctic marine areas.

(iii) Funds should be sought from all available sources to expedite production of a Lancaster Sound Oil Spill Response Atlas.

3.1.6 Education, Communication and Consultation

(i) The federal and territorial governments should intensify the level of their information exchange, education and consultation efforts relating to marine environmental quality in support of devolution, joint management and political development initiatives for the North.

(ii) The federal and territorial governments should make reports, visual aids and other scientific and marine environmental management information available to northern communities in laymen's terms and in native languages.

INTERMEDIATE-TERM ISSUES

3.2.1 Inputs From Land-Based Sources

(i) River water quality and discharge objectives and controls should be implemented. An increased understanding and interpretation of the physical/chemical characteristics of riverine inputs is essential to protecting and managing the marine environment.

(ii) The effectiveness of management over on-shore activities (e.g., river water quality and discharge, and land-based industrial discharges) should be improved to reflect effects on the marine environment.

(iii) Impact assessment reviews for major projects having significant potential effects on marine resources and the marine environmental (e.g., hydroelectric development and shorebases) should be included as part of regulatory, licensing and approvals processes.

(iv) Trans-boundary agreements (such as the Mackenzie River Basin Agreement and the Montreal Guidelines - United Nations Environment Programme) should be recognized as essential management tools for protecting the marine environment, negotiations completed and these agreements implemented.

3.2.2 Dredging

(i) Indian and Northern Affairs Canada and Environment Canada should continue to coordinate the administration of dredging activities and abandonment of artificial islands, to ensure that cumulative impacts are minimized.

3.2.3 Ocean Dumping Control

(i) Indian and Northern Affairs Canada should complete an overall waste management strategy for Yukon and the Northwest Territories, which assesses the pros and cons of ocean dumping as well as other options.

(ii) Indian and Northern Affairs Canada should ensure that appropriate consultation occurs with other government departments, industry and the communities on the overall waste management strategy.

3.2.4 Data Bases

(i) Scientific and regulatory agencies in cooperation with industry and universities should seek to provide greater access to and utilization of Arctic marine data bases.

(ii) Efforts should be undertaken to overcome barriers to the interchanging of data bases, including archival methods, data retrieval and transmission systems and information exchange on the quality of existing data sets.

(iii) Marine environmental data from Hudson Bay should be identified as a unique opportunity for pooling data from federal, territorial and provincial agencies in Quebec, Ontario and Manitoba.

(iv) The Arctic Data Cataloguing and Appraisal Program (Fisheries and Oceans) should be maintained, updated and extended throughout the Arctic as appropriate to problem-solving needs and available support from its clients.

3.2.5 Jurisdictional Coordination

(i) The Departments of Indian and Northern Affairs and Environment should support efforts by the Department of Fisheries and Oceans to improve the level of coordination for federal research programs and management activities affecting the Arctic marine environment through the Interdepartmental Committee on Oceans (ICO).

(ii) Other opportunities for improved multi-jurisdictional coordination affecting the marine environment should be sought by Fisheries and Oceans, Indian and Northern Affairs and Environment at the regional level and within the Northwest Territories.

(iii) An environmental management plan involving land-based activities affecting the marine environment, environmental impact review processes and emergency responses should be prepared for Hudson Bay by the federal government, the Government of the Northwest Territories and the Governments of Quebec, Ontario and Manitoba.

LONG-TERM ISSUES

3.3.1 Noise

(i) The Department of Fisheries and Oceans should seek opportunities for further research to determine the effects of noise from ships and other industrial sources on marine mammal behaviour and distribution.

(ii) All new information on the effects of noise on marine mammals should be conveyed to Inuit hunters through community education and consultation by federal departments in cooperation with the Government of the Northwest Territories and industry.

3.3.2 Ice Regime Alteration

(i) Research and demonstration projects should be undertaken to determine the effects of ships tracks on access across sea ice, on ringed seal and narwhal distributions and on Inuit harvesting success.

3.3.3 Shoreline Modification

(i) Research by the Department of Fisheries and Oceans on coastal fish and habitats to determine the effects of shoreline modifications such as port facilities, causeways and breakwaters on migrating fish stocks should continue and should be coordinated with Alaskan coastal fish migration studies.

(ii) Studies on coastal processes (e.g., physical/chemical processes) should continue in order to improve predictions of the effects of shoreline modifications on coastal fish.

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1.0 INTRODUCTION

The federal departments of Environment, Fisheries and Oceans, and Indian and Northern Affairs sponsored a workshop in Yellowknife, Northwest Territories on Arctic Marine Environmental Quality, on June 1 and 2, 1988. Nineteen participants from these departments and other agencies with a direct interest in the quality of marine waters in the Canadian Arctic attended. In total, the agencies represented embody much of the spectrum of interests, expertise and responsibilities of the governments' marine environment in the North.

The objectives of the workshop were:

(i) to examine the applicability and significance of new federal initiatives as they relate to marine environmental quality in the North;

(ii) to consider the contribution of activities which are on-going to new marine initiatives;

(iii) to identify any new opportunities that may exist through on-going programmes; and

(iv) to identify other opportunities for cooperation and enhancement of marine environmental quality.

The workshop was held in response to two initiatives by the federal government during 1987. These were release of the Arctic Marine Conservation Strategy for the Department of Fisheries and Oceans, and adoption of a framework for managing marine environmental quality by Conservation and Protection, Department of the Environment. Other contributing influences included release of an Ocean's Policy for Canada (Fisheries and Oceans) and a National Marine Parks Policy (Environment); interest sparked by the Brundtland Commission (UNEP); and the establishment of a system for State of Environment reporting (Environment Canada and Statistics Canada).

The workshop participants reviewed on-going federal/territorial programmes and new initiatives followed by a brief discussion of the definition of Marine Environmental Quality. Workshop participants split into two working groups to produce a set of recommendations on programme activities and scheduling priorities that would lead to improved measures to maintain and enhance the quality of the marine environment. These were discussed in plenary by all participants, and consensus was reached on the recommendations and actions presented in this report.

Plenary consideration of the workshop objectives revealed that the issues and their corresponding actions to seek or implement solutions were not homogeneous. Some issues could be addressed directly and immediately using existing knowledge and expertise. Other issues are complex or require long periods of data collection and analysis before results can be expected. Many of the essential contributors to some recommendations were already assembled at the workshop while other issues required international, circumpolar or even global attention. The state of readiness through existing preparations and on-going programmes was determined to differ between issues as well.

As a result of these differences, the workshop participants chose to group the results of their deliberations and analyses according to their perceptions of the opportunity for significant resolution and implementation over time. This produced three categories: short-term, intermediate and long-term. The priority and urgency of intermediate and long-term issues, however, is not lessened by the need for longer term commitments before solutions can be developed and implemented.

Appendix I provides a list of participants and the workshop agenda. A brief summary of the presentations on on-going programmes is contained in Appendix II.

1.1 BACKGROUND

Arctic marine environmental management responsibilities in the federal government are vested in a number of departments including Indian and Northern Affairs, Fisheries and Oceans, Environment, Transport, National Defence, Energy Mines and Resources, and the Canada Oil and Gas Lands Administration, with centres of expertise and authority located throughout Canada. In addition, there are two territorial governments (Northwest Territories and Yukon), four provincial governments (Quebec, Ontario, Newfoundland, and Manitoba) and the emerging native organizations (Inuvialuit Regional Corporation) that also manage activities which affect the northern marine environment. Their regulatory activities are coordinated through a series of committees.

In addition to the myriad of committees that manage activities affecting Arctic marine environmental quality, there have been a number of new initiatives including attempts to link environmental and economic management. These initiatives include the Oceans Policy for Canada; the development and implementation of the Arctic Marine Conservation Strategy; the National Marine Parks Policy; the definition of a framework for marine environmental quality; a system for reporting on the state of the Canadian environment; delegation of programme responsibility to the territorial governments; and the establishment of Land Use Planning Commissions in the Northwest Territories and Yukon. Each of these initiatives can contribute to the maintenance of marine environmental quality.

Several new initiatives have been launched which attempt to address specific responsibilities for the marine environment. Each of these initiatives can contribute to the maintenance of marine environmental quality. These initiatives include efforts to link environmental management, economic activity and sustained resource development. Other initiatives include:

- the Oceans Policy for Canada;
- implementation plans for the Arctic Marine Conservation Strategy;
- the National Marine Parks Policy;
- a framework for marine environmental quality;
- the State of Environment reporting system;
- delegation of programme responsibility to the territorial governments;
- establishment of Land Use Planning Commissions for land, freshwater and marine waters in the Northwest Territories and Yukon.

2.0 WORKSHOP DEFINITION OF MARINE ENVIRONMENTAL QUALITY

2.1 BOUNDARIES

The Arctic marine environment as discussed in the context of this workshop encompasses the area depicted in Figure 1. It includes all marine waters bordering the Northwest Territories and the Yukon Territory, and includes Hudson Bay, James Bay, and Ungava Bay. This is also the area for which the Arctic Marine Conservation Strategy is being developed.

2.2 MARINE ENVIRONMENTAL QUALITY SCOPE

The objective of managing marine environmental quality is to maintain, protect and enhance the quality of the marine environment to allow for sustained resource use and other benefits (tourism, recreation, diverse marine ecosystems) for the enjoyment and use of existing and future generations.

Marine environmental quality can be defined as:

> *the condition of the marine environment, measured relative to current and intended uses and relative to objectives and limits set to reflect environmental, health and resource concerns*

The workshop participants found that gaining a specific grasp on the concept of marine environmental quality was a challenging task. This presented a serious obstacle to viewing potential issues and recommendations in a unified context. A simplified notion was needed that would reflect enough of the basic linkages at work in the system to put each marine quality concern into perspective. The elementary model that is found in Figure 2 helped to satisfy this need.

The marine environment is a complex ecosystem. Constantly in motion due to tides, currents, waves and winds, this three dimensional universe has a network of interrelationships between its physical and chemical properties and its biota. Each point in the system is a reflection of the effects from direct uses of the marine environment and the culmination of effects from land-based activities. The latter taking place through run-off, freshwater discharges and atmospheric deposition.

Aboriginal peoples who live along Canada's northern coasts depend on the marine environment for transportation, tourism, and resource harvesting for subsistence and commercial use. Other uses of the marine environment in the North are generally associated with transportation and industrial development of non-renewable resources. In order to maintain the quality of the marine environment, all on-site users must take into account the capacity of the marine ecosystem which includes the residual effects from long-range transport and from land-based activities.

The management and regulatory regimes which are responsible for maintaining marine environmental quality in arctic waters are limited to activities taking place on-site in Canada's territorial waters. This arrangement excludes marine waters outside Canada's jurisdiction, atmospheric emissions and land-based activities. Research and other scientifically-based programmes are an important tool for management and regulatory decisions. Figure 2 identifies five factors as the key variables for management and regulatory decisions affecting marine environmental quality: resource harvesting, disturbance, habitat change, effluent discharges, and external influences.

Figure 1: Area Covered Within the Arctic Marine Environment

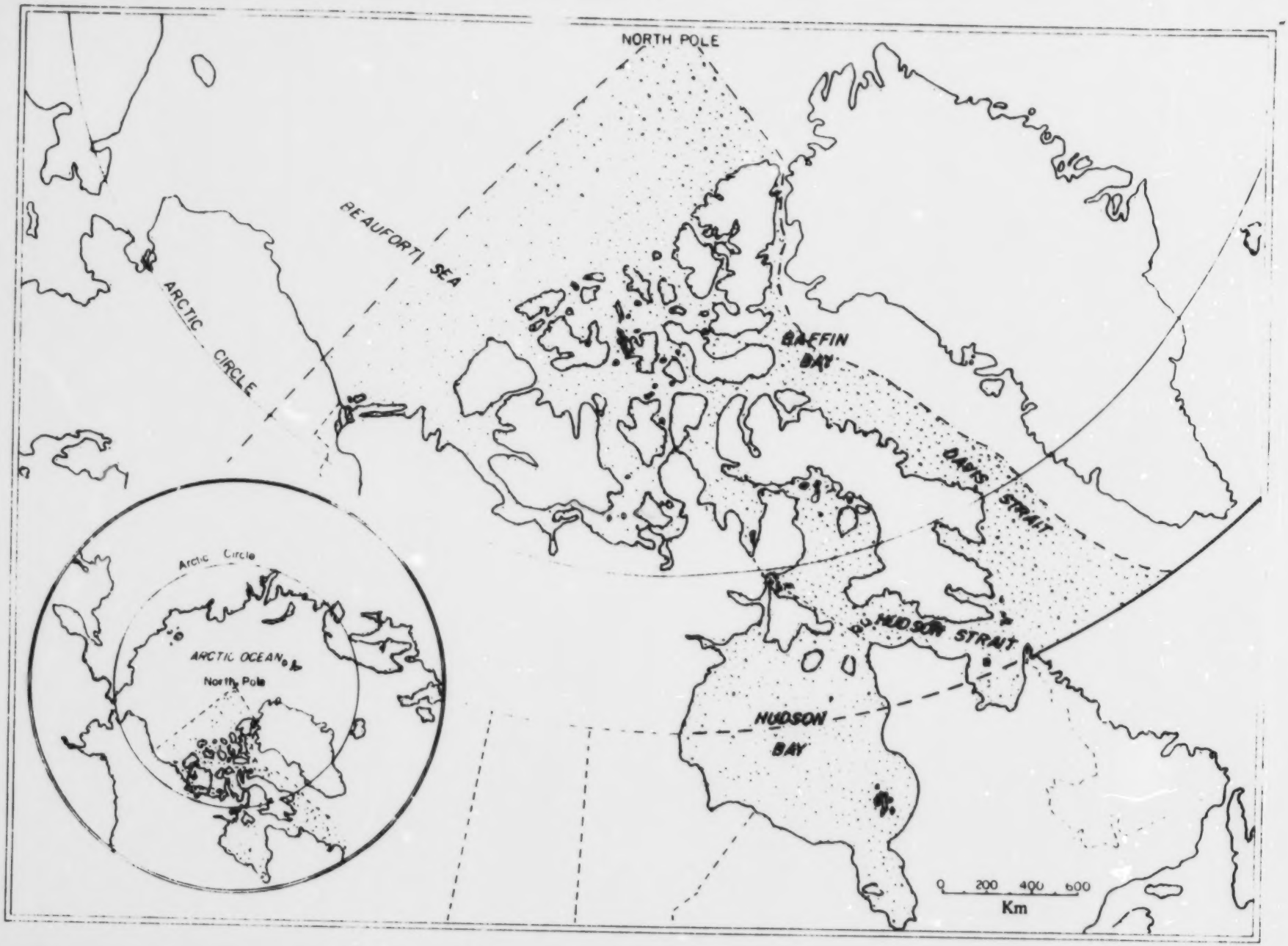

FIGURE 1: AREA COVERED WITHIN THE ARCTIC MARINE ENVIRONMENT

Figure 2: Environmental Equality of Northern Marine Waters

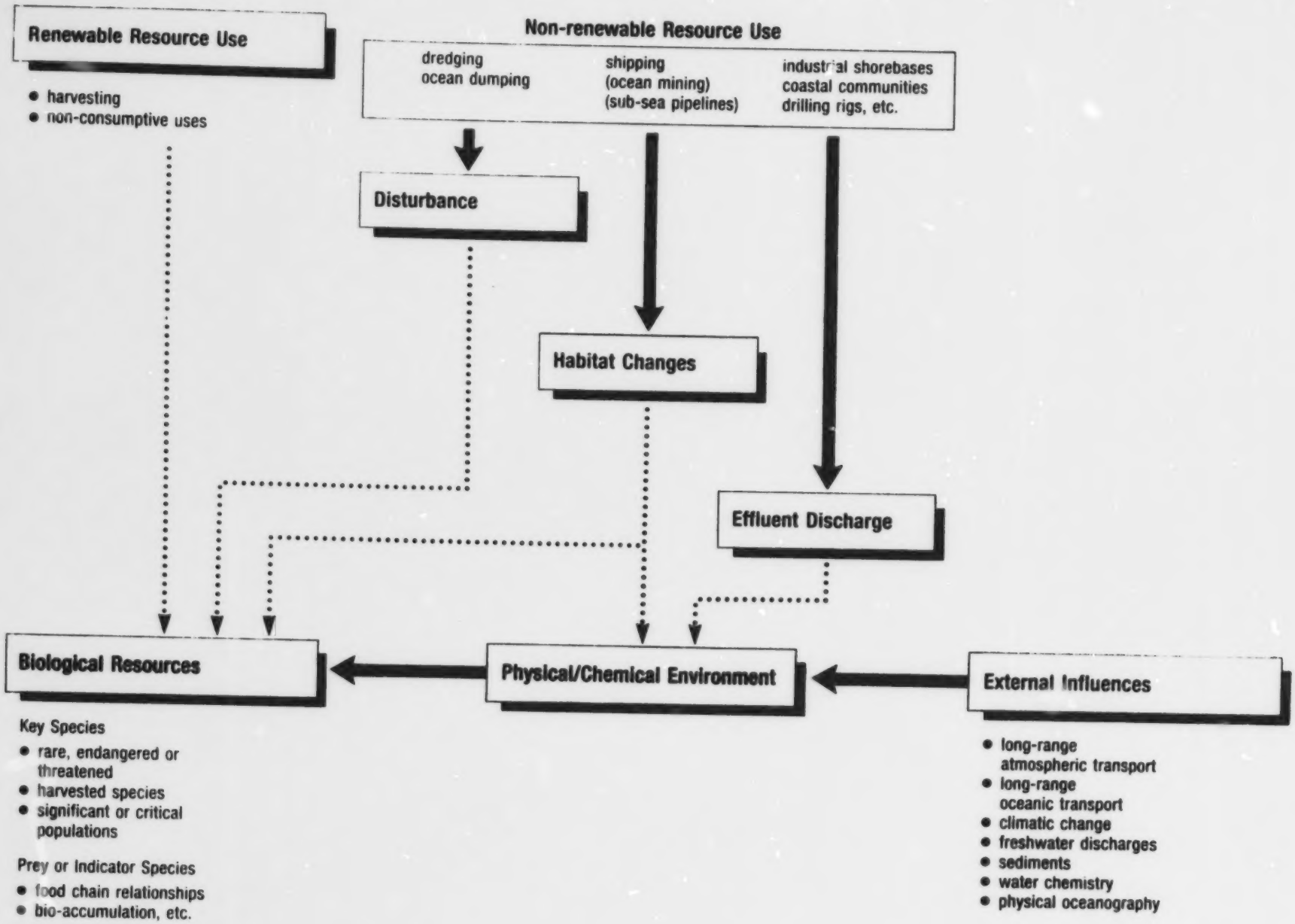

FIGURE 2: ENVIRONMENTAL QUALITY OF NORTHERN MARINE WATERS

USES OF THE MARINE ENVIRONMENT

RENEWABLE RESOURCES

Non-Renewable Resource Use and Development

Sub-sea pipelines
Dredging (Mining)
On-Site Effluent Discharges

Ocean Dumping
Shipping
Shorebases
(Communities)

Harvesting - Non-Consumptive Uses

Biological Resources

Key Species
- rare, endangered or threatened
- harvested resources
- significant/critical populations

Prey Species
- food chain

DISTURBANCE

HABITAT CHANGE

Physical/Chemical Environment

- sediments
- water chemistry
- physical oceanography
- atmospheric effects

EFFLUENT DISCHARGES

- long-range atmospheric transport of contaminants
- long-range oceanic transport of contaminants
- climatic change
- freshwater discharges

EXTERNAL INFLUENCES

3.0 ISSUES AND RECOMMENDATIONS

The workshop participants identified sixteen Arctic marine environmental quality issues, proposed recommendations and rationales, and divided them into the following categories:

(i) short-term - issues that are being addressed or can be now, within the status quo, in terms of resources, institutional structures, and timing;

(ii) intermediate-term - issues that are resolvable but effective resolution requires a longer period of time and involves adjustment to the status quo; and

(iii) long-term - issues that are fluid, complex, dependent on numerous factors and involve significant adjustment to the status quo: thereby requiring a longer period of attention.

3.1 SHORT-TERM ISSUES & RECOMMENDATIONS

3.1.1 Arctic Marine Environmental Quality Criteria and Standards

ISSUE:

Environmental quality standards do not exist for the Arctic marine environment.

RECOMMENDATIONS:

(i) A working group should be established to determine whether marine environmental criteria are required for the Arctic. If it is determined that criteria and standards are required then the working group:

(ii) Should identify parameters for which criteria or standards would be useful;

(iii) Should determine whether area-specific criteria and standards are required (i.e., are different criteria and standards required for Lancaster Sound, the Beaufort Sea and Hudson Bay?); and

(iv) Should recommend on a process to begin development and implementing a complete set of criteria and standards within five years.

RATIONALE:

Arctic marine environmental criteria and standards are needed in order to establish terms and conditions for regulatory approvals, make decisions on mitigative measures, monitor changes and to use as a basis for action to prevent contamination. However, the best method of assessment is to measure change over time.

Criteria and standards are only an aid to interpreting changes in environmental quality. The ongoing assessment of Arctic marine environmental quality is constrained by the fact that environmental quality criteria and standards, against which trends can be compared, have not been established. By developing environmental quality criteria and standards for Arctic marine water, sediment, and biota (including acceptable contaminant body burdens), the results of monitoring programmes can be interpreted more readily. Some monitoring programmes will involve native residents and hunters, thereby drawing on their traditional knowledge and familiarity with marine areas and resources.

3.1.2 Reporting on the State of the Arctic Marine Environment

ISSUE:

A system for reporting on the state of Arctic marine environmental quality is needed to document quality trends and to ensure public awareness of Arctic marine issues.

RECOMMENDATIONS/ACTIONS:

(i) Environment Canada should complete its draft report entitled "Present Status of Arctic Marine Environmental Quality" to reflect the issues discussed at this workshop.

(ii) The above draft report should be forwarded to agencies represented at the workshop for review prior to producing the final report for publication by March 31, 1989.

(iii) A state of the Arctic marine environment report should be produced every five years (i.e., next report should be produced in the fiscal year 1993/94).

RATIONALE:

As part of the national effort on State of the Environment reporting, the development of a status report every five years which provides a summary of the concerns, issues and management priorities associated with the state of Arctic marine environmental quality is reasonable strategy for the North. The reports would describe industrial activities, uses of Arctic marine areas and resources, describe contaminants and waste sources which affect the marine environment, and propose potential research assessment, monitoring and control opportunities, identify problem areas and key issues, discuss the degree to which the water column, sediments and biota have been affected by human uses, and identify trends.

3.1.3 Long-Term Environmental Monitoring Programmes

ISSUE:

Long-term data do not exist to identify trends and to assess the effectiveness of management decisions in protecting Arctic marine environmental quality.

RECOMMENDATIONS:

(i) Well designed, comprehensive, long-term monitoring programmes should be established to identify trends in Arctic marine environmental quality.

(ii) The monitoring programmes should be designed address long-range transport of contaminants and local contamination issues.

(iii) Joint monitoring programmes between government departments and industry should be pursued.

(iv) Industry and government agencies should work together to seek resources for the monitoring programmes.

RATIONALE:

Limited environmental monitoring programmes have been conducted to measure impacts from industrial activities and data on long-range transport of contaminants in the Arctic marine environment is effectively non-existent. Additional monitoring data can be used to evaluate trends in marine environmental quality, identify pending environmental problems, verify impact predictions, determine

the effectiveness of regulatory controls and mitigative measures, establish baselines against which future change can be measured, evaluate the effectiveness of pollution control equipment, and increase the understanding of natural processes. The trends identified from monitoring programmes will continue to be important to the regulatory decision-making process and to evaluate the effectiveness of management efforts to minimize degradation of the marine environment.

3.1.4 Marine Protected Areas

ISSUE:

A network of marine protected areas in the Arctic is required to maintain and conserve marine environmental quality.

RECOMMENDATIONS:

(i) The Department of Fisheries and Oceans, Canadian Wildlife Service and Canada Parks Service should continue their initiatives to establish a network of marine protected areas throughout the Arctic.

(ii) The selection of areas for protection should be based on appropriate biophysical and socio-economic information, and should reflect input from area residents, other government departments and industry.

RATIONALE:

The primary objective in establishing a network of Arctic marine protected areas is to protect and conserve for all time those places which are significant examples of Canada's Arctic marine natural heritage or represent important habitats for high priority marine species. Marine protected areas should include areas designated for cultural, scientific, educational, aesthetic, recreational or biological purposes, or to maintain natural conditions or preserve certain features. Differing levels of protection should be applied to different types of protected areas, as appropriate; some other activities (e.g., resource harvesting) may be allowed in some types of protected areas.

3.1.5 Oil Spills

ISSUE:

Arctic marine oil spill response and countermeasure capabilities need to be enhanced to ensure protection of Arctic marine environmental quality.

RECOMMENDATIONS:

(i) Government and industry should work together to compile existing oceanographic and atmospheric data to support the refinement of oil spill trajectory models and identify information gaps which hinder such refinement.

(ii) An oil spill response atlas should be developed next for Lancaster Sound and then possibly for other Arctic marine areas.

(iii) Funds should be sought from all available sources to expedite production of a Lancaster Sound Oil Spill Response Atlas.

RATIONALE:

Oil spills represent a major pollution threat to the Arctic marine environment. Arctic oil spill response and countermeasure capabilities are essential, particularly in areas where the greatest risks exist. There are two areas where concern over the potential effects from oil spills is particularly high: the Beaufort Sea and Lancaster Sound. The Beaufort Sea is an area of oil and gas exploration and development. Industrial activities in the Lancaster Sound area include the annual sealift which supplies communities with diesel fuel and gasoline, the transport of Arctic crude oil to market, and the shipping of oil and petroleum products to the Nanisivik and Polaris lead-zinc mine sites. These uses bring with them the potential for spills.

An environmental atlas for Beaufort Sea oil spill response has been produced. A similar atlas is needed for Lancaster Sound. The Lancaster Sound region has national and international significance both as an important marine transportation route and as a unique environment that requires careful conservation and management. Other areas which could be considered include Hudson Bay and the Eastern Arctic.

3.1.6 Education, Communication and Consultation

ISSUE:

All Canadians, including Northerners, require more information as the basis for gaining a better understanding of marine environmental quality and of the effects from current and future uses of the marine environment. A better awareness of the relationships affecting the quality of the marine environment will enable more effective participation by the people of northern Canada and elsewhere in decisions affecting Arctic marine conservation.

RECOMMENDATIONS:

(i) The federal and territorial governments should intensify the level of their information exchange, education and consultation efforts relating to marine environmental quality in support of devolution, joint management and political development initiatives for the North.

(ii) The federal and territorial governments should make reports, visual aids and other scientific and marine environmental management information available to northern communities in laymen's terms and in native languages.

RATIONALE:

Education, communication and consultation play an important role in ensuring that industry, government and the public are aware of the state of the Arctic marine environment. Increased public awareness of the marine environment, its benefits, the importance of marine conservation and of a healthy marine environment will develop and promote conservation. This enhanced public understanding will, in turn, provide more public support to government initiatives aimed at meeting marine environmental quality objectives and will encourage the development of private and community-based programs aimed at conserving the marine environment.

3.2 INTERMEDIATE-TERM ISSUES & RECOMMENDATIONS

3.2.1 Inputs From Land-Based Sources

ISSUE:

Chemical contamination from land-based sources (e.g., riverine inputs, direct run-off and waste discharges) can have major effects on the quality of the marine environment.

RECOMMENDATIONS:

(i) River water quality and discharge objectives and controls should be implemented. An increased understanding and interpretation of the physical/chemical characteristics of riverine inputs is essential to protecting and managing the marine environment.

(ii) The effectiveness of management over on-shore activities (e.g., river water quality and discharge, and land-based industrial discharges) should be improved to reflect effects on the marine environment.

(iii) Impact assessment reviews for major projects having significant potential effects on marine resources and the marine environmental (e.g., hydroelectric development and shorebases) should be included as part of regulatory, licensing and approvals processes.

(iv) Trans-boundary agreements (such as the Mackenzie River Basin Agreement and the Montreal Guidelines - United Nations Environment Programme) should be recognized as essential management tools for protecting the marine environment, negotiations completed and these agreements implemented.

RATIONALE

Contaminants in riverine inputs affect the overall quality of the Arctic marine environment. For example, the Mackenzie River provides a significant natural hydrocarbon input to the southern Beaufort Sea area estimated at 1.8×10^7 kg per year (Thomas *et al.*, 1986). Known anthropogenic sources (e.g., accidental spills of fuels and oils, hydrocarbons entrained in discharged drilling wastes) are relatively minor, contributing an average of approximately 1.68×10^5 *l* of hydrocarbons annually between 1976 and 1985 (Northern Spills Report Service, 1972 to 1985; Turney *et al.*, 1986).

Hydroelectric power developments such as those established on the Churchill and Nelson rivers in northern Manitoba, and in northern Quebec, can alter the flow and thermal regimes of rivers and can result in an increased input of contaminants to the marine environment. These developments have been linked to inputs of mercury which affect the water quality of Hudson Bay.

Industrial discharges and direct run-off from land-based developments can affect the quality of the Arctic marine environment. Diesel oil, jet fuel, gasoline, crude oil and minerals have entered the marine environment as a result of spills from onshore tank farms and other shore-based facilities even though the spills may not have necessarily entered the marine environment directly. These spills have resulted in elevated hydrocarbon levels in local marine environments. Similarly, elevated levels of metals may be found adjacent to mine sites and tailings discharges or ore spills.

3.2.2 Dredging

ISSUE:

Minimizing the cumulative environmental impacts from future large dredging projects in nearshore areas (e.g., Yukon North Slope port facility; Beaufort Sea pipeline trenching), and from local dredging and gravel extraction projects is a priority in terms of preserving marine environmental quality.

RECOMMENDATIONS:

(i) Indian and Northern Affairs Canada and Environment Canada should continue to coordinate the administration of dredging activities and abandonment of artificial islands, to ensure that cumulative impacts are minimized.

RATIONALE:

Dredging activity in the offshore Canadian North has occurred primarily in the Beaufort Sea where between 1959 and 1985 a total of 163 dredging operations were carried out, representing a total dredged material volume of 57,273,300 cubic metres (Sackmann *et al.*, 1986). Short-term studies have determined that Beaufort Sea dredging has resulted in some localized increases in suspended sediment concentrations and turbidity as well as the destruction of benthic habitat at dredging and dumping sites (Thomas *et al.*, 1985). While effects from dredging operations generally are localized and short-term, it is the long-term cumulative effects of many dredging projects which represents a potential concern in terms of habitat destruction, etc., particularly if contaminated material from abandoned artificial islands or berms is dredged again for use at other sites.

3.2.3 Ocean Dumping Control

ISSUE:

Ocean disposal of wastes affects the quality of the Arctic marine environment.

RECOMMENDATIONS:

(i) Indian and Northern Affairs Canada should complete an overall waste management strategy for Yukon and the Northwest Territories, which assesses the pros and cons of ocean dumping as well as other options.

(ii) Indian and Northern Affairs Canada should ensure that appropriate consultation occurs with other government departments, industry and the communities on the overall waste management strategy.

RATIONALE:

Ocean disposal is an option for disposing of wastes from development activities in the Arctic and it is often the least expensive approach. There is a need to develop an overall waste management strategy to ensure that the ocean does not become the repository for all wastes. Indian and Northern Affairs Canada is developing such a strategy, and Environment Canada is identifying optimal areas for use as common-user ocean disposal sites. Such a strategy would ensure that wastes are managed in an environmentally acceptable manner by considering numerous options including recycling, shipment of wastes to the South, land disposal, incineration, and ocean dumping.

3.2.4 Data Bases

ISSUE:

Better utilization of Arctic marine data bases requires improved coordination, access, storage and availability for use.

RECOMMENDATIONS:

(i) Scientific and regulatory agencies in cooperation with industry and universities should seek to provide greater access to and utilization of Arctic marine data bases.

(ii) Efforts should be undertaken to overcome barriers to the interchanging of data bases, including archival methods, data retrieval and transmission systems and information exchange on the quality of existing data sets.

(iii) Marine environmental data from Hudson Bay should be identified as a unique opportunity for pooling data from federal, territorial and provincial agencies in Quebec, Ontario and Manitoba.

(iv) The Arctic Data Cataloguing and Appraisal Program (Fisheries and Oceans) should be maintained, updated and extended throughout the Arctic as appropriate to problem-solving needs and available support from its clients.

RATIONALE:

For purposes of assessment, planning, regulation and research in the Arctic marine environment, it is necessary to compile data on offshore industrial activities such as oil exploration and development in the marine environment. In response to the need for better coordination and reliability of existing data and greater access to Arctic data sets, the Department of Fisheries and Oceans, the Institute of Ocean Studies, Sidney, B.C., and the Freshwater Institute at Winnipeg, has prepared numerous Arctic data information and cataloguing systems. These data bases have included the Arctic Data Cataloguing and Appraisal Program (ADCAP), the Oceanographic Data Information System (ODIS), the Marine Biophysical Atlas Data Base for the Canadian Arctic, the Arctic Industrial Activities Compilation Program, and the Arctic Offshore Drilling Chemicals Data Base. The value of these systems was recognized and it was recommended that the programmes be continued and enhanced where appropriate. These data compilations do not cover the Hudson Bay area and this was recognized during the workshop as an important deficiency which should be addressed.

3.2.5 Scientific Knowledge and Support

ISSUE:

There are significant information gaps that need to be filled relating to natural Arctic marine processes.

RECOMMENDATIONS:

(i) Essential data gaps should be identified and priorities set as the basis for introducing project proposals through departmental planning processes; opportunities for cooperative financial support should be pursued to the maximum extent that is necessary.

RATIONALE:

Additional scientific information is required on the biological importance of polynias (e.g., Northern Water) and on chemical-physical-biological processes as relating to renewable and non-renewable resources and uses. Better decisions about marine uses and marine environmental quality depend on

improvements in the level of understanding for natural marine processes. Inter-governmental cooperation and information exchanges with circumpolar countries may present an opportunity for enhancing and implementing the approaches identified through the Arctic Marine Conservation Strategy.

3.2.6 Jurisdictional Coordination

ISSUE:

The maintenance and enhancement of Arctic marine environmental quality requires a concerted effort by all levels of government, industry and communities in the Arctic.

RECOMMENDATIONS:

(i) The Departments of Indian and Northern Affairs and Environment should support efforts by the Department of Fisheries and Oceans to improve the level of coordination for federal research programs and management activities affecting the Arctic marine environment through the Interdepartmental Committee on Oceans (ICO).

(ii) Other opportunities for improved multi-jurisdictional coordination affecting the marine environment should be sought by Fisheries and Oceans, Indian and Northern Affairs and Environment at the regional level and within the Northwest Territories.

(iii) An environmental management plan involving land-based activities affecting the marine environment, environmental impact review processes and emergency responses should be prepared for Hudson Bay by the federal government, the Government of the Northwest Territories and the Governments of Quebec, Ontario and Manitoba.

RATIONALE:

The need for close coordination among the various agencies responsible for managing activities which affect the Arctic marine environment is important, particularly with respect to the management activities that affect Hudson Bay. The management responsibilities for Hudson Bay are vested in numerous federal departments, the Government of the Northwest Territories and three provincial governments (Quebec, Ontario and Manitoba). Additional boards and committees evolving through land claim agreements will increase the need for effective coordination and cooperation to protect marine resources and environmental quality.

3.2.7 Long-Range Transport of Contaminants

ISSUE:

International cooperation, particularly with circumpolar countries, is necessary to maintain Arctic Marine environmental quality.

RECOMMENDATIONS:

The departments of Environment, Fisheries and Oceans, and Indian and Northern Affairs should continue their efforts to document and monitor the effects of long-range transport, atmospheric and oceanic transport of contaminants, and to promote national and international control strategies.

RATIONALE:

Industrial emissions throughout Asia, Europe and North America have affected the quality of the Arctic marine environment as a result of long-range transport through the atmosphere, rivers and by ocean

currents. Two examples of this phenomena, which have been documented, are Arctic Haze and the concentration of organochlorine contaminants through the food chain in fish and marine mammals. As the concentration of contaminants increases throughout the oceans and airsheds affecting Arctic marine waters, the effects of long-range transport increasingly will extend to these relatively pristine waters. The presence of contaminants in those marine resources which are part of Inuit diets is a particularly pressing concern.

3.3 LONG-TERM ISSUES & RECOMMENDATIONS

3.3.1 Noise

ISSUE:

Vessel noise may significantly affect marine mammal behaviour and distributions. Noise from ships and industrial sources is part of marine environmental quality to the extent that it affects marine mammals and their harvest by Inuit hunters.

RECOMMENDATIONS:

(i) The Department of Fisheries and Oceans should seek opportunities for further research to determine the effects of noise from ships and other industrial sources on marine mammal behaviour and distribution.

(ii) All new information on the effects of noise on marine mammals should be conveyed to Inuit hunters through community education and consultation by federal departments in cooperation with the Government of the Northwest Territories and industry.

RATIONALE:

Sources of industrial underwater noise include freighters involved in the annual sealift, offshore oil and gas supply vessels, ice-breakers, mineral ore carriers, dredges, drillships and artificial islands. The noise originates from engine operation, dredge-head operation, the impact of ice against the vessel hull, and propeller cavitation (the depressurization of bubbles against a ship's propeller). Concerns have been raised that underwater noise from industrial operations may interfere with communication and the normal behaviour of marine mammals. Marine mammal response to industrial noise has been studied and a short-term avoidance response to vessel traffic has been noted (Finley *et al.*, 1984; Miller and Davis, 1984; Richardson *et al.*, 1985). The degree to which marine mammals avoid sources of underwater noise and the effects that this may have on Inuit harvesting patterns and success still needs to be clarified so the best mitigative measures can be introduced in order to minimize any environmental degradation.

3.3.2 Ice Regime Alteration

ISSUE:

Ship's tracks may affect travel across sea ice and marine mammal harvesting.

RECOMMENDATIONS:

(i) Research and demonstration projects should be undertaken to determine the effects of ships tracks on access across sea ice, on ringed seal and narwhal distributions and on Inuit harvesting success.

RATIONALE:

The Inuit have identified a conflict between shipping routes and harvesting activities. Of particular concern is an extended shipping season resulting from the use of more powerful ice-breaking vessels, and its possible impact on marine mammal species and hunting success. The full range of possible options needs to be explored for avoiding or minimizing the effects of ship tracks on Inuit activities in conjunction with extended shipping.

3.3.3 Shoreline Modification

ISSUE:

The construction of nearshore structures such as shorebases, causeways and shallow-water hydrocarbon production facilities in the Beaufort Sea may affect coastal fish stocks, particularly those of anadromous species (e.g., Arctic cisco, Arctic Char and broad whitefish).

RECOMMENDATIONS:

(i) Research by the Department of Fisheries and Oceans on coastal fish and habitats to determine the effects of shoreline modifications such as port facilities, causeways and breakwaters on migrating fish stocks should continue and should be coordinated with Alaskan coastal fish migration studies.

(ii) Studies on coastal processes (e.g., physical/chemical processes) should continue in order to improve predictions of the effects of shoreline modifications on coastal fish.

RATIONALE:

Nearshore structures along the Yukon coast could disrupt fish migration patterns by changing the salinity and temperature regimes in the nearshore zone. Studies on the effects of the ARCO causeway at Prudhoe Bay have provided evidence that causeways can alter the distribution of young Arctic cisco. Other studies conducted along the Yukon coast have delineated the nearshore migratory patterns of anadromous fish, characterized inshore habitats, and provided information on the natural variability in temperature and salinity; however, the potential effects of shoreline modifications on coastal fish warrant continued studies.

4.0 CONCLUSIONS

In addition to reaching a consensus on the recommendations, the participants agreed to immediately undertake action on five items as follow-up to the workshop.

4.1 ARCTIC MARINE ENVIRONMENTAL QUALITY CRITERIA AND STANDARDS

Representatives from Environment and Fisheries and Oceans agreed to establish a working group to begin working on these recommendations. This will be a joint effort by the Northwest Territories District of Environmental Protection and the Freshwater Institute in Winnipeg.

4.2 REPORTING ON THE STATE OF THE ARCTIC MARINE ENVIRONMENT

The draft report on industrial discharges from marine-based activities and their relationship to some representative parameters for marine environmental quality will be finalized by Environmental Protection, Northwest Territories District in consultation with the Environment and Conservation Directorate and Environmental Services and Research, Indian and Northern Affairs, and the Arctic Research Committee on Offshore Development (ARCOD), Department of Fisheries and Oceans. The development of a format for the State of the Arctic Marine Environment Report will follow, early in fiscal 1989-90.

4.3 MARINE PROTECTED AREAS

The selection and establishment of protected areas, as recommended by the Task Force on Northern Conservation and acknowledged by the Arctic Marine Conservation Strategy and the Northwest Territories Conservation Strategy being prepared by the Department of Renewable Resources, Government of the Northwest Territories, is an on-going activity. Several candidate areas have been identified to the Lancaster Sound Land Use Planning Commission and are the subject of on-going community consultations. Additional candidate areas have also been ear-marked for further consideration during the land use planning exercise for the Beaufort Sea and through community consultations in the Inuvialuit Settlement Region.

The Department of Fisheries and Oceans will establish a working group with representatives from the Canadian Wildlife Service and the Canadian Parks Service to promote implementation of marine protected areas under the Arctic Marine Conservation Strategy.

4.4 OIL SPILLS ATLAS FOR LANCASTER SOUND

An unsolicited proposal has been submitted to prepare a spill atlas for Lancaster Sound. Environment Canada is supporting this proposal and will seek additional support through the Department of Fisheries and Oceans, the Canadian Coast Guard - Transport Canada, the Canada Oil and Gas Lands Administration and the Northern Land Use Planning Program - Indian and Northern Affairs Canada.

4.5 INFORMATION, COMMUNICATION AND CONSULTATION

The transformation of work in marine sciences with its unfamiliar terminology and techniques into everyday language is a significant challenge. This process is even more challenging when another culture is involved and enough simplification is required to translate the messages into a native language. The workshop participants agreed that if substantial progress is going to be achieved over the long-term, immediate action is necessary.

Opportunities to improve the levels of awareness and understanding about marine environmental quality arise repeatedly during the course of many government programs in the North. In order to be successful, the individuals who conduct these programs must assume responsibility for better information exchanges, communication and consultation with Northern communities.

In addition to those items identified for immediate action, the workshop participants also recognized that work is currently on-going on numerous issues which they had identified. The opinion of the group, however, was that bringing attention to the importance of these issues and recommendations would reinforce their priority in terms of conservation of the Arctic marine environment.

It is likely that some of the intermediate and long-term issues will be the most difficult to address successfully. The introduction of new technology, such as more powerful ice-breaking vessels, cannot be tested until this equipment is operational. The use of demonstration projects may be one approach to gaining the appropriate background information to reflect concerns over marine environmental quality.

For other intermediate and long-term issues, complex or long-term data sets must be collected before the issue can be resolved. The cost of some of the recommended activities may be quite large, requiring a significant commitment by governments and/or industry and other sources of financial support (e.g., foundations, universities, etc.).

The workshop convened with the four objectives that were stated in the introduction. From the results of the workshop it was evident that the Arctic Marine Conservation Strategy is a comprehensive attempt to come to grips with marine-related issues in the Arctic; that the Conservation Strategy and the framework for marine environmental quality are mutually supportive; and that the numerous federal initiatives, including the National Marine Parks Policy, Northern Land Use Planning, and State of Environment report, in combination, cover a wide range of marine environmental quality concerns.

On-going activities are making a notable contribution to the conservation of marine environmental quality through research, regulation and management. There always is room for more to be done and priorities change as the issues shift. Nevertheless, the sharing of information on existing programs was enlightening because it revealed a scale of activity that may not have been anticipated.

Opportunities to apply existing expertise and knowledge and to direct programs which are on-going to meet new needs may be the best pathway to addressing marine environmental concerns. Pending a sizable increase in the level of available resources, the burden of dealing with tomorrow's needs most likely will call on today's programs.

The final objective was to identify opportunities for cooperation and enhancement of marine environmental quality. The workshop furnished a fertile bed for the seeds of cooperation as common interests became clearer. Several short-term issues will be addressed on a cooperative basis and joint-ventures to implement various recommendations can be expected over the coming months and perhaps years.

A spirit of cooperation was pervasive throughout the workshop, leading to earnest and frank but nevertheless productive deliberations. The participants also concluded that the workshop was a worthwhile experience. They proposed that another gathering should be scheduled in the future to review the status of the issues and recommendations, especially what progress had been made on the action items and other short-term issues.

Throughout the two days of the workshop many ideas and issues were presented and discussed. Though there were differences of opinion on some specific issues and on which issues were a priority, there was unanimous agreement on the underlying issues and principles required to ensure that the quality of the Arctic marine environment is preserved. Only through continued cooperative efforts on existing program initiatives and on developing new initiatives among the various government agencies will protection and enhancement of Arctic marine environmental quality occur.

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APPENDIX I

LIST OF PARTICIPANTS

AND

AGENDA OF THE ARCTIC MARINE ENVIRONMENT WORKSHOP

APPENDIX I

LIST OF PARTICIPANTS

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AGENDA
MARINE ENVIRONMENT WORKSHOP

2nd Floor Boardroom
Northern United Place

June 1 and 2, 1988
Yellowknife

JUNE 1

0830 1. Welcome and opening remarks
2. Plenary: Overview Presentations
Marine Environmental Quality Programs and Interests
- mandate and responsibilities
- on-going programs and new initiatives
- policy initiatives
Time: 30 minutes or less per agency.

0845 - 1145 Department of Fisheries and Oceans (DFO), Canada Oil and Gas Lands Administration (COGLA), Environment Canada (DOE), Northern Land Use Planning (NLUP), Indian and Northern Affairs Canada (DIAND), Department of Renewable Resources, Government of the Northwest Territories (DRR/GNWT)

1145 Synthesis and general discussion

LUNCH

1300 3. Achieving a working understanding of MEQ:
- common assumptions
- concepts
- statement of objectives

1400 4. Working Groups:
How well does the status quo contribute to/support MEQ?
- what are we doing now and how adequate is it?
- what needs to be done to satisfy MEQ objectives: gaps and opportunities?

1600 5. Plenary: Presentation of Results

JUNE 2

0830 6. Plenary: Where do we go from here?

0900 7. Working Groups
Scoping a MEQ response for Northern waters
- examining the applicability and significance of new initiatives to MEQ in the North
- identifying new opportunities that may exist through on-going programs: Working better and smarter?
- identifying other opportunities for cooperation and for enhancing MEQ

LUNCH

1300	8.	Plenary: Results from working groups
1345	9.	Opportunities and undertakings: - immediate and specific - intermediate but attainable - longer term requiring support
1545	10.	Synopsis and concluding remarks
1615		Adjourn

APPENDIX II

OVERVIEW OF GOVERNMENT ACTIVITIES RELATED TO ARCTIC MARINE ENVIRONMENTAL QUALITY

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OVERVIEW OF GOVERNMENT ACTIVITIES RELATED TO ARCTIC MARINE ENVIRONMENTAL QUALITY

1. Environmental Protection/Conservation and Protection

(a) National MEQ Programs
(b) Five year MEQ Action Plan produced to meet C&P responsibilities includes:

- federal strategies (including shellfish and ocean dumping activities)
- federal/provincial strategies
- State of Environment reporting
- monitoring techniques
- status and trends monitoring
- comprehensive MEQ guidelines

(c) MEQ Advisory Group formed which reports directly to the MEQ Regional Director General Steering Committee.
(d) Western and Northern Region Programmes
(e) Mandate and Responsibilities:

- Section 33 of Fisheries Act - deposit of a deleterious substance into waters frequented by fish
- Ocean Dumping Control Act (ODCA) - permits, enforcement activities
- Clean Air Act (CAA)
- Environmental Contaminants Act (ECA)
- Overall responsibility to ensure that federal government does not degrade environmental quality
- Arctic MEQ - issues are different compared to National MEQ program. Examples include:
  (i) no shellfish programme
  (ii) coastal zone management not yet an issue
  (iii) long-range transport is an evolving issue
  (iv) additional levels of government being added through land claims

(f) On-going Programmes/New Initiatives:

- administer the Ocean Dumping Control Act/ocean dumpsite selection
- ensure that Fisheries Act (33) requirements are complied with in approvals issued under the authority of other legislation:
  (i) Arctic Waters Pollution Prevention Act
  (ii) Canada Oil and Gas Production and Conservation Act
  (iii) Public Lands Grants Act
  (iv) Northern Inland Waters Act
- respond to spills from federal operators and mystery spills
- compile summary documentation on the state of Arctic marine environmental quality
- studies of the fate and effects of contaminants - site-specific studies have included Tuktoyaktuk Harbour biological monitoring, as well as shorebase and offshore studies
- development of standardized principles and procedures for monitoring
- shoreline drift waste surveys

(g) Policy Initiatives:

- Canadian Environmental Protection Act - includes ODCA, CAA and the ECA
  (i) enforcement policy
  (ii) regulated chemicals

(g) Policy Initiatives: (Continued)

- Fisheries Act enforcement policy
- marine environmental quality policy framework.

2. Department of Fisheries and Oceans

(a) Fisheries and Habitat Management

- stock assessment
- habitat characterization
- terms and conditions for licenses/permits for industrial activities
- licensing of fishermen
- inspection and enforcement under the Fisheries Act
- inspection of interprovincial and export fisheries products
- development of small craft harbours
- Northern Land Use Planning

(b) Scientific Programs - Biological sciences

- arctic fish (anadromous and marine)
- marine mammals
- arctic marine ecosystems

Scientific Programs - Physical/Chemical

- ice research
- remote sensing
- hydrocarbon budgets
- long-range transport of contaminants

Scientific Programs - Hydrography

- Bent Horn, Beaufort Sea and other Arctic areas

(c) Data Bases

- Marine Environmental Data System (MEDS)
- Arctic Data Catalogues and Assessment Programme
- Arctic Industrial Compilation Series

(d) Policy Initiatives

- Oceans Policy for Canada - Canada Oceans Act, Marine Science Plan, other strategies
- Arctic Marine Conservation Strategy - six strategies, Arctic MEQ (strategy four), consultation with communities and other government departments to begin this summer.

3. Indian and Northern Affairs Canada (INAC)

(a) Enabling Legislation

Department of Indian Affairs and Northern Development Act - resource and environmental management on crown lands

(a) Enabling Legislation (Continued)

- Arctic Waters Pollution Prevention Act (AWPPA)

  (i) regulates the disposal of wastes into marine environment from non-shipping sources
  (ii) controls Arctic shipping through ice (administered by Transport Canada)

- Northern Inland Waters Act (NTWA)

  (i) regulates discharges of wastes to Arctic waters from land-based operations (Water Boards, Technical Advisory Committee)

- Public Lands Grants Act (PLGA)

  (i) regulates dredging activities through a licensing mechanism
  (ii) provides authority for leasing the seabed for construction and disposition of artificial islands and berms

- Territorial Lands Act (TLA)

  (i) controls land use and development activities on land adjacent to the marine environment

- Environmental Assessment and Review Process (EARP) - Order in Council

  (i) implements EARP through project review by the Regional Environmental Review Committee (RERC)
  (ii) develops screening and assessment criteria

(b) Implementation of a Network of Protected Areas (from Northern Conservation Task Force)

- review of International Biological Program (IBP) sites, migratory bird sanctuaries

(c) New Initiatives

- devolution to Territorial governments
- Land Claim agreements

  (i) Inuvialuit
  (ii) Dene/Metis
  (iii) Tungavik Federation of Nunavut (TFN)

- proposed Northern Accord - may govern ownership of surface and subsurface rights (see COGLA)

4. Canada Oil and Gas Lands Administration (COGLA)

(a) Enforce regulations under the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act.
(b) Northern Accord may come into effect in a few years.
(c) Environmental Protection Branch - protection of the natural environment:

(c) Environmental Protection Branch (Continued)

- biological, physical and chemical data
- effects on drilling regulations and offshore oil and gas drill waste guidelines

(d) Research and development

- A-Base funds
- Panel on Energy Research and Development (PERD)
- Environmental Studies Research Fund (ESRF)

(e) PERD - Energy, Mines and Resources Canada (EMR) lead role (PERD fund began 1984)

- Section 6.7
  - (i) environmental management
  - (ii) includes many research studies such as Fate of Environmental Pollutants, Environmental Impact Modelling of Oil Spills, Oil Spill Behaviour and Dispersion in the Arctic, Oil-Based Drilling Muds research

(f) ESRF

- considerable amount of down-sizing recently
- new ESRF Management Board being set-up
- 86 reports produced to date including bowhead whale research, ice scouring studies and environmental effects of oil-based drilling muds

5. Canada Parks Service

(a) National Marine Parks Policy - designation of marine protected areas, approved in 1986

- 29 regions selected across Canada (marine and Great Lakes)
- 10 regions in the North - select representative areas, National Areas of Exceptional Interest
- Currently working on three regions:
  - (i) Lancaster Sound (proposal within 3-4 years) (North Baffin/Lancaster Sound/Eclipse Sound)
  - (ii) Viscount Melville Sound
  - (iii) Beaufort Sea - identified three candidate areas but not close to selecting areas
- marine parks within 12 mile limit
- marine parks may encompass Northwest Passage for sovereignty rights

(b) New Initiatives - development of a National Marine Parks Strategy, links already developed between fisheries habitat management and marine parks.

6. Canadian Wildlife Service (CWS)

(a) Environmental assessment input provided through representation on Arctic Waters Advisory Committee (AWAC) and Land Use Advisory Committee (LUAC)
(b) Seabird and colony research
(c) Migratory birds habitat research along the Beaufort Sea coastline
(d) Polar bear research (e.g. contaminant uptake studies)
(e) Polynias and leads research e.g., North Water Research Study

7. Atmospheric Environment Service (AES)

   (a) Collection of land-based data and sea-based data
   (b) Satellite imagery - ice cover
   (c) Provide marine forecasts
   (d) Production of an ice atlas for North of 60°
   (e) Study break-up of landfast ice - possible delays due to artificial islands
   (f) Oil spill trajectory forecasts
   (g) Polar lows

8. Northern Land Use Planning Commission

   (a) Lancaster Sound Regional Land Use Planning Commission - submission of draft Lancaster Sound Regional Land Use Plan
   (b) Beaufort Sea/Mackenzie Delta Regional Land Use Planning Commission
   (c) Numerous environmental constraints/issues considered including:
      - oil and gas activities
      - shipping corridors and impacts of shipping (e.g., ship tracks)
      - ocean dumping - selection of dumpsites
      - noise effects on marine mammals
      - ice patterns - landfast ice
      - polynias and leads - critical areas that need to be protected
      - harvesting
      - sustainable development
      - tourism and economic development
      - sovereignty and defense
      - renewable resource conservation

9. Government of the Northwest Territories

   (a) Circumpolar Conservation Strategy
   (b) Polar bear research
   (c) Carry out impact assessments as an advisory body to AWAC, RODAC, RERC, TAC
   (d) Northwest Territories Land Use Planning Commission
   (e) New initiatives - develop environmental protection policies and acts